THE ELECTRICAL WORLD

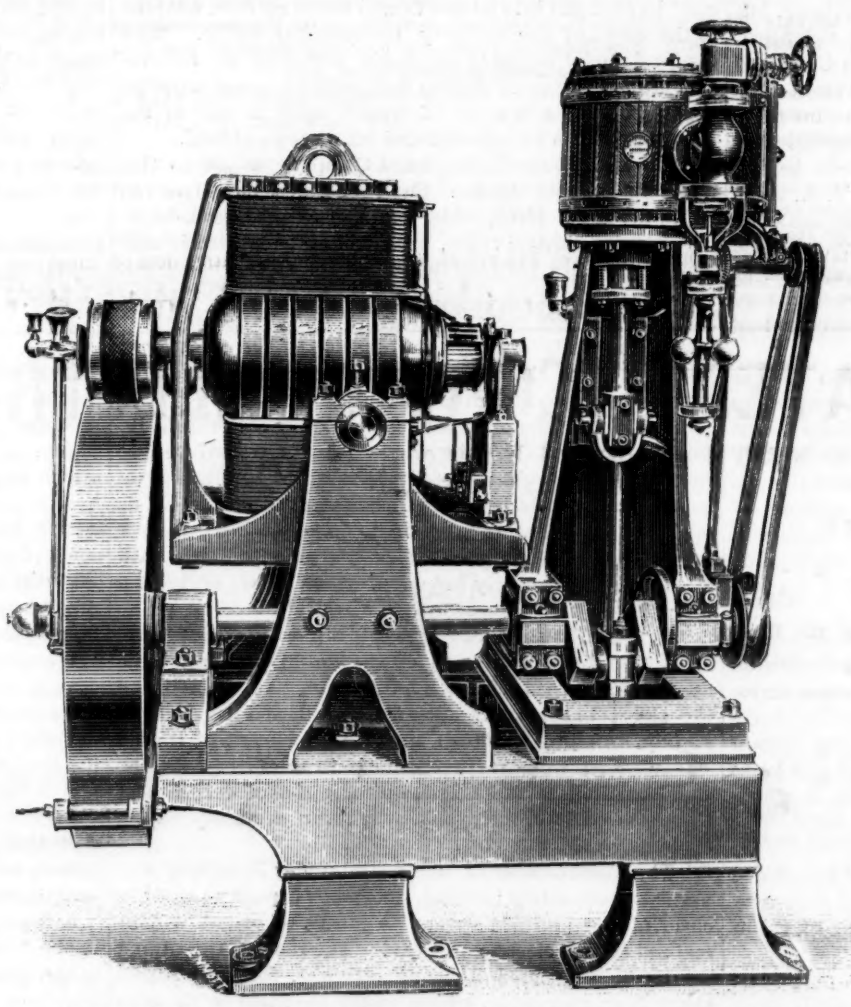
VOL. IV.—No 6. NEW YORK, AUGUST 9, 1884. $2 PER ANNUM. 5 CENTS A COPY.

Frictional Arrangement for Driving Dynamos.

We illustrate herewith an arrangement for driving dynamo machines by means of friction gear introduced by Mr. G. S. Raworth, of Manchester, England, agent to Messrs. Siemens Brothers & Company, Limited, and already much used with much success in ship lighting, as for instance on the steamships "Vancouver," "City of Rome," "City of Chicago," "Aurania," "Chusan," "Tasmania," and many other vessels.

Our illustration is taken from a photograph, reproduced by the *Mechanical World*, of machinery for use on the steamship "H. C. Oersted." The engine rated as four horse-power, made by Messrs. Deaken, Power & Co., of Salford, and has a cylinder six and a half in. in diameter and eight in. stroke. The shaft is made extra long and carries at its end a fly-wheel thirty-six inches diameter and five inch on face. This drives the dynamo pulley, which is a bowl of compressed paper eight inches diameter and three inches wide on the paper face. An extremely novel and ingenious method is adopted for carrying the dynamo itself, which is placed on and firmly fixed to a cast iron cradle presenting in end view a U form. Placed on the side of the two forked branches are trunnions bearing in the cast-iron supports or standards and on which the cradle can swing with the machine. The centre line of the trunnions passes through the centre of gravity of the machine and is also in the same horizontal plane as though at right angles to the line of contact between the fly-wheel and the friction pulley. By this means the weight of the paper pulley is borne by the fly-wheel and that of the machine by its supports, so that all unnecessary strain is taken from the dynamo bearings. Tightening of the driving and driven wheels is effected entirely by means of two outside bearings cast in phosphor bronze. These are connected together by long half-inch bolts with thumb screws and spring washers, so that the two rolling surfaces are kept well in contact. A wheel guard (not shown in the illustration) protects the fly-wheel and pulley from water and oil. Running at its normal speed the engine makes 200 revolutions and the machine 900 revolutions per minute, giving an E. M. F. of about one hundred volts, and sufficient current for sixty 20 candle-power Swan incandescent lamps, or five 1,000 candle power arc lamps, all arranged in parallel circuit. The engine and standards carrying the machine and cradle with a crosspiece for the end shaft bearing are bolted down on two horizontal cast-iron beams, which are in turn bolted to and supported by four cast-iron feet secured to the deck or foundation.

The dimensions over all are, respectively, 5 feet in length, 5 feet 11 inches in height, and 3 feet 2 inches in width, so that the whole arrangement is most admirably compact and well fitted for the purpose it is intended to fulfill.



FRICTIONAL ARRANGEMENT FOR DRIVING DYNAMOS.

The Field Electric Railway Interests.

In the *Mail and Express* of the 2d inst. appeared a long and highly interesting article on Mr. Stephen D. Field and his inventions. Most of it related to the subject of electric railways, and we quote as follows:

In his boyhood he showed a taste for mechanics and for electrical experimenting. He became a telegraphic operator before he was 16, up among the hills of Berkshire County, where, after two removals across a continent, he at last proved the electric railway a success. In his 17th year the boy went with his family to San Francisco.

He was first employed in California as an operator for the California State Telegraph Company. In 1865 he assisted in the construction of the Russo-American Telegraph Line, under the direction of Mr. Frank L. Pope, whom he had known as a boy in Massachusetts, and who afterward, as a patent solicitor, entered his application for a patent on the electric railway. It was in this year hat he first learned of the successful solution of the problem of producing electric currents by mechanical means in the magneto-electric, and later in the dynamo-electric machine.

During the year 1868 he constructed two electro-motors. The first—a rough model only—was made from an old magnet, some clock wheels and stray pieces of iron he had picked up in the office. This model worked, and its success encouraged him to have a larger one constructed under his direction. Experiments with the first model proved to him that a galvanic battery would be too cumbersome and costly a means of producing a current ever to become practically useful, and he then endeavored by correspondence to find out the possibility of procuring large power machines.

The object in constructing these first motors was to run street cars in San Francisco. Mr. Field's efforts to obtain a dynamo-electric machine were unsuccessful at the time. In 1871 he associated himself with Mr. Geo. S. Ladd and others in the organization of the Electrical Construction and Maintenance Company, of which he acted for nearly seven years as secretary and electrician. In 1877 he went to Europe, and there, at the workshop of M. Breguet in Paris, he saw some Gramme machines, which were exactly suited to the purpose of furnishing a current for his projected motor. On his return from Europe, two of these machines were ordered by Mr. Ladd, but after considerable delay the Californians were informed that Breguet would not send the machines, being afraid of invalidating some of his patent rights in the United States. Upon receipt of this information, a machine was immediately ordered from Siemens Bros., of London.

At last their hopes seemed about to be realized and the long cherished project of applying electricity to locomotion was in a fair way to be practically tested, but another disappointment awaited them. The hoped-for dynamo was lost at sea on the way to San Francisco. Nothing daunted by this misfortune, they promptly ordered another machine, and at last, in the fall of 1878, it arrived. At the same time two Gramme machines were placed at their disposal by the Hon. Milton S. Latham. With these, experiments were made in a loft on Market street, and an elevator loaded with 1,500 pounds of coal was made to ascend and descend by their agency.

The possibility of moving a load and of controlling and reversing the motion by means of an electric current supplied by a dynamo machine was now proved beyond a doubt. In February, 1879, Mr. Field elaborated his plans for an electrical railway and made drawings of a motor, which is substantially the same as that afterward put in operation by him at Stockbridge. In May of that year a caveat was filed by him in the United States Patent Office, which covered a claim for an electric tramway motor, the current to be supplied by a stationary source of power and connected with the rails. By means of a secondary machine on the motor the current would be converted into power to be supplied to the axles of the car by suitable gearing, and so the car would be propelled. The claim also covered a method of reversing the motion of the car by reversing the direction of the electric current.

This was the very first official record of a plan for a dynamo-electric railway.

In July, 1879, at the solicitation of friends, Mr. Field came to New York, and placed the matter of filing an application for a patent in the hands of his old friend, Frank L. Pope. This application was filed March 10, 1880.

Up to this time, the electric railway was all on paper. It was considered advisable by Mr. Pope that a working model should be constructed and operated, so in May of that year Mr. Field began at Stockbridge the building of a railway and an electric motor. The machines he first experimented with proved worthless, and he was obliged to stop work until he could procure funds to buy others. This he finally succeeded in doing, and in 1881 the road was in successful operation.

Meantime the Siemens Brothers had been experimenting on electric railways in Europe, and had constructed several that worked well on a small scale. Mr. Edison had also been at work on the same problem, and built his well-known little railway at Menlo Park. The inventions of the three investigators clashed, and on applying for patents they came in collision. It was soon found that the application of Siemens was subsequent to those of both Edison and Field, and it was thrown out. The trial between the two remaining competitors was long and tedious. The testimony was taken two years ago, but it was only last week that the final decision, awarding priority of claim to Field, was announced. The caveat filed in 1879, with its rude accompanying sketch, was shown to be, as has already been stated, the very first official record of a plan for operating an electric railway.

Pending the result of the contest in the Patent Office, a consolidation of the Field and Edison interests was effected in 1883, and the Electric Railway Company of the United States came into existence.

The article goes on to describe the road built at the Chicago railway exposition by Mr. Frank B. Rae, in 1883, and fully illustrated and described in THE ELECTRICAL WORLD of Aug. 4, 1883. It concludes thus:

The Electric Railway Company of the United States failed to enrich anybody but its president, Mr. C. W. Rogers, and it is now practically dead, although no formal dissolution has taken place. Mr. Field says he is ready to go ahead and build and run an electric railway for anybody that wants one, and take upon himself the responsibility of settling any difficulty that may arise with the company aforesaid.

This method may be used for all sorts of railways—underground, ordinary street surface and elevated. Elevated roads present the fewest difficulties. The rails are almost perfectly insulated, the distance is not too great, and the grades are not heavy. A perfect success could be made on such roads at the first attempt. For surface street railways, it is necessary to have the conducting rails laid in a slot, so that they will not become covered with mud and lose their conductivity.

A company is now operating in Cleveland, having appropriated one of Mr. Field's patents, which attempts to run cars on the ordinary rails. They will probably not run a great while.

It is not proposed, as yet, to operate roads of a greater length than ten miles or so. The influence of the station

ary generator would not be effective at a much greater distance than that. Additional generators could be put in, and a current supplied to as long a line as was thought desirable; but for use in cities, one source of power would supply enough force to run the whole length of a road.

The Daft Electric Railway.

Mr. Leo Daft has given publicity to the subjoined, which is of great interest at the present time, when public interest in electric railways and the transmission of power shows such a remarkable awakening:

"The statement in Monday's *Commercial Advertiser*, that the electric railroad at the Iron Pier, Coney Island, is simply a catch-penny arrangement, is not just, and I can hardly think the gentleman quoted was properly understood, when alluding to it. The company with which I am connected, although it supplied the motor, has nothing to do with its exhibition at Coney Island, but at the same time I feel it my duty to say that the railroad is an illustration of a principle which has become a known fact—that cars can be put in motion by electricity. The principle has been tested up to 50 horse-power, and can be to 500 horse-power, moving a train of cars carrying 700 tons of coal. The statement that the electrical street railway which went into operation in Cleveland, O., last Saturday, is the first successful application of the principle, is also incorrect. I have been at work for more than two years on motors of this character, and have demonstrated, more than eighteen months before any one else did, the practicability of the principle of electric railways.

"As to the priority of invention, there are many witnesses who can prove that I exhibited an electric motor of this character twenty years ago, and I think this can be shown to be long before any one else ever claimed to have done such a thing. At my company's factory in Greenville, N. J., can be seen not only an electrical railway, but motors of greater power than any ever before exhibited, capable of doing all the work claimed by the Cleveland street railway, and more still. Even at the present time there are in two buildings on Spruce street elevators moving by the same force, each elevator acting independently of the other, and showing that the power can be distributed. In the model railway at Greenville, N. J., there are cars running independently of each other on the same track, yet operated from the same central dynamo. These cars can be moved forward or backward, or stopped at pleasure, much quicker than if the motive power were steam, as electricity is more rapid in its movements than steam.

"The principle on which the motor attached to the car is set in motion is the same as that of a steam motor, where the power is furnished by means of supply and exhaust pipes. The practicability of the electric motor is likely soon to be tested on one of the side branches of the elevated railway, when the roadway is made capable of properly receiving the electric current. The track will then be so perfect that accident from disconnected joints in the rails will become impossible, for if a joint became imperfect the current also would be imperfect.

"The arrangement of the tracks by my process can be be such that, although the cars may be put into motion on the street surface by electricity in the rails themselves, ordinary vehicles may cross the tracks, and neither horse nor vehicle be in any way affected by the electric current with which the rails may be charged. The cars will be so easily manageable that no trouble will arise from collisions when ordinary care is exercised; certainly not more, if so much, as is experienced now with the horsepower used for street cars. By my improvement I shall be enabled always to supply to the rails the exact amount of electricity required, and also to operate a large number of trains simultaneously without loss of power.

"With regard to the 'parallel' system of running cars, *i. e.*, running a number of motors or trains entirely independent of one another on the same track at the same time, I have a strong patent on the means of successfully accomplishing this, and further I have actually had four so operating at once nearly two years ago by apparatus which was clearly capable of indefinite extension in this direction by a mere increase of dimensions in the primary or station dynamo-machine.

"I have built the most powerful electric motor ever attempted, which has towed a load of about twenty tons on an ordinary railroad track up a grade of ninety-three feet per mile, which is considerably more than has ever been done in Europe or elsewhere. By reason of recent modifications this motor is capable of much heavier work.

"The road at Coney Island operated by my system and apparatus is certainly the first electric railroad in America opened for public use, and though small, as compared with our other motors, is capable of carrying fifty passengers, which it frequently does, and we may therefore regard even this with some complacency if compared with other achievements.

"I mention these points merely to show that I reduced the system of electric power transmission, both for stationary and locomotive purposes, to a thoroughly practical basis many months ago; and, therefore, in common fairness these statements should be made as showing my priority in the matter of solid practical application."

The Broadway Electric Railway.

Col. Rowland R. Hazard, the President of the Gramme Company, has expressed himself to a *Sun* reporter in the following able statement with regard to the proposed Broadway electric railway:

"Broadway is the most noted street in America, and it was for a time the handsomest street. It is now disfigured by poles of every size, height, and condition of decrepitude, by miles of wire following and crossing it at all angles. Its structures are disfigured by gallows-like erections used for supporting the wires, and its pavement is a broken, ridged and unsightly expanse unfit for travel, and noisy enough to destroy the nerves of Spartans. Sky line and street line are alike disfigured, and the beauty of Broadway is simply a tradition.

"Travel has been diverted from it to parallel thoroughfares, to the detriment of its values. The result is that, notwithstanding the vast sums expended in the construction of fine buildings along its line, its comparative value has declined along with its beauty and convenience. Now it is proposed to cap the climax of confusion and ugliness by introducing surface railroads, either horse or cable, and, under the pretense of an improvement, to complete its destruction.

"Plausible lawyers, employed by clever promoters, have succeeded in obtaining the consent of some abuttors to their scheme, partly, no doubt, by taking some of them into partial partnership, and partly because, after a long contest, objectors have, in desperation, abandoned all hope of saving or restoring Broadway.

"Broadway ought now to be dealt with as a scientific street. The advance in constructive art and in electrical science has placed within the resources of the engineer the means of dealing with the street so that it will become the most perfect street in the world. Occupying as it does the ridge of the island, it is free from the obstructions which exist in every other street, and can, with moderate cost, be changed into a smooth and silent surface, adapted to the wants of the ordinary metropolitan traffic. This can be done by means of an arcade requiring an excavation of only fifteen or sixteen feet, with electrical railways therein, having a capacity of transit equal to that of the Third and Ninth avenue elevated railways combined.

"The Broadway Underground Company might do this under its existing charter. Such obstructions as now exist, in the sewer pipes, water pipes, gas pipes, steam-heating pipes, pneumatic tubes, etc., would be placed in convenient galleries between the tunnel and the curb, accessible at every point for examination, connection and repair, and avoiding the incessant tearing up of the pavement which constantly destroys the surface of the roadway at present. These side galleries could be entered by doors from the stations along the line.

"This disposition of Broadway would benefit everybody, would injure nobody, and would leave the surface free from disturbance of all sorts. In addition to this a pavement such as has been placed in Paris and London, could be used. It is a scientific pavement, composed of concrete and asphalt, resting upon buckle plates or arches, with wooden blocks properly prepared, which would compose a beautiful and noiseless street.

"New Yorkers are accustomed to regard the wood pavement with disfavor, because of the absolutely unscientific use to which wood has heretofore been put. Heretofore the street has been composed of wood, and has decayed rapidly, and broken down under the pressure of traffic. The modern wooden pavement is as solid as a rock, the wood bearing the same relation to it that a carpet does to a marble floor, removable whenever necessary at an extremely moderate cost.

"The requirements of such a road under Broadway are, first, absolute safety; second, enormous capacity; third, a cheerful and pleasant street. All these requisites will be realized in the electric railway. The roof of the tunnel would be supported by steel columns, forming panels about four feet wide, which could be filled with non-resonant material to secure comparative silence. The foundation could be of concrete, except under the columns, where it should be of granite. The carriages could be composed of steel, covered with non-resonant material similar to the panels composing the tunnel. The tunnels themselves are compressed under the law within eight feet eight inches. The centre section of the tunnel could be occupied by express trains of seven carriages running at three-minute headway. The side tracks could be used by way trains of four carriages running at one minute headway. The passage of these trains through the tunnel would operate to ventilate the tunnel by establishing a continuous current of air, each train acting as a piston in a cylinder.

"The stations could be approached by entrances from the sidewalk connecting by galleries across the street. It is obvious that any carriages constructed of this indestructible material driven along such a way, and employing an electric current, will introduce elements of safety and comfort and progress that will meet the emergency.

"The cost of this scientific street is less than that of any which has ever been devised. The minimun of excavation is obtained by putting the pipe chambers at the sides. The maximum of accommodation is reached, and the comparatively narrow tunnel secures the least possible displacement of the street, combined with absolute security and safety."

Edison on Electric Motors.

Mr. Thomas A. Edison has expressed his views freely to a *Tribune* reporter in regard to the electro-dynamic motor for which Stephen D. Field, a nephew of Cyrus W. Field, some time ago obtained a patent. The claims of the latter to priority of invention over the motors of Mr. Edison and Dr. Siemens were recently allowed by a Patent Office decision. Mr. Field has complained that, having pooled his patents with those of Mr. Edison in the Electric Railway Company of the United States, Mr. Edison, when asked to allow him to take out his patents and close out the concern, gave him no satisfaction, and Mr. Field has declared that if his hands were not thus tied he would at once apply the motor to the Forty-second street branch of the New York Elevated Railroad, on which the company had offered to allow the experiment to be made. Concerning this Mr. Edison said:

"Mr. Field tried an experiment concerning the use of electricity as a motor with an elevator, and he calls that applying the motor to a railroad, and says that if it will go up and down, a car will go along on a track. I have built a railroad three miles long at Menlo Park, on which I ran at the rate of forty-two miles an hour with my electric motor, and carried six or eight freight cars. It is a real practical thing. I could not go on with it because I had not time. I had too many other things to attend to, especially in connection with electrical lighting. Field's people were afraid they would lose their patents, and wanted to consolidate with me. The practical parts of the invention are mine. I consolidated with them, and since then they have done nothing. If I had been separate from them in this matter I would have appealed the case and would have won it, but as we were consolidated I do not need to do so; and now, because I did not defend the case, he wants to withdraw his patents from the pool. I am not willing to let him withdraw after having put my invention in and allowed him to get his decision. He couldn't have got it on any such nonsense as running an elevator. I am willing he should apply it to the Elevated Railroad. If he wants to do so he can have all the profits, so far as I am concerned. I guess all the others interested would consent to have it introduced in this way. I am keeping pretty busy. I am going into original experimenting again. I'll get out a new crop of inventions during the next year in the electrical line."

Comparison of the Transmission of Force by Electricity with the Other Most Common Mechanical Transmissions.

BY A. BERINGER.

If we admit that the local conditions are equally favorable to the four systems (viz., electricity, water under pressure, compressed air and telo-dynamic cables), that is to say, if we set on one side particular considerations which may render one or the other system more suitable in a given case, the comparison of prices shows that electricity and telo-dynamic cables are the most favorable agents for the transmission of power. Between these two we must choose the cable as effecting the cheaper transmission up to a distance of 1 kilometre, but for greater distances electricity is preferable.

We note, in passing, the interesting result that a hydraulic motive power transmitted by electricity to a distance of 20 kilometres costs less than the same power produced on the spot by a large improved steam-engine, even if we calculate the water-power at 0.03 franc per horse-power hourly. It follows that a powerful waterfall will supply, within a radius of four leagues, power cheaper than that produced by steam-engines of 100—200 horse-power, and within a far wider radius it will compete advantageously with small steam-engines, or with gas.

Although cables are very suitable for distributing power in the country to a few separate places, they are quite out of the question when it is required to effect unlimited subdivisions, *e. g.*, in a distribution of power from house to house in a town. In this case the three other systems remain alone in the field.

For distances of less than 1 kilometre, electricity has only the advantage of a few centimes over air and water, but its advantage increases for longer distances. Thus the hourly cost per horse-power for ½ kilometre is 0.24 franc; for 1 kilometre, 0.25 franc, and for 12 kilometers, 0.37 franc, whilst water and air reach this price for 1½ to 2 kilometres.

Transmissions by water and air are therefore far surpassed by electric transmission, and if we wish to produce power by steam in a central establishment and distribute it from house to house within a radius of 10 kilometres, electricity alone could furnish an economical solution of the problem.

We must here remark that such a distribution of power can only be for the present useful in the small trades, for if more than 10 horse-power is required a special motor is more advantageous.

If we divide the region to be supplied with power into squares of 8 to 10 kilometres a side, having each a large steam-motor, we may supply a horse power at 0.25 franc hourly as against 0.32 franc, which would be the cost of a gas-motor, which is considerable economy in favor of electricity.

There are numerous cases where local conditions render

it impossible to set up a motor at the place where the power is required, and only certain systems of transmission can here be employed. Thus in mining and tunneling, air and electricity only are applicable, and if we suppose that there is need for 10 horse-power, we see, on comparing the price of this power transmitted by compressed air and by elcetricity, that the advantage is greatly in favor of the latter. For more considerable transmissions of power the prices agree fairly well up to 5 kilometres, but beyond this the advantage of electricity becomes very decided. In addition, an electric transmission is more easily established than the conduction of compressed air, and it is much easier to extend a system of the first kind than of the second.

Certainly boring-machines with compressed air often suffice for ventilation, whilst an electric transmission of power requires to be accompanied by especial appliances for this purpose. Still the advantages of electricity as regards convenience and economy are so great that we cannot hesitate to employ it whenever there is no fear that sparks from the dynamo machines may occasion explosions, especially as electricity can at the same time serve for lighting.

In conclusion, in cases were telo-dynamic cables are not applicable, electric transmission is much preferable to transmission by water or compressed air. It is more economical than gas-motors for transmissions up to 5 kilometres. Where transmission by cable is applicable it is the more economical up to 1 kilometre. From 1 to 5 kilometres electricity has the advantage.—*Revue des Mines.*

An English Electrical Tramway.

Mr. M. Holroyd Smith, engineer, of Halifax, has recently been engaged upon the task of applying electricity to tramway purposes, and a few days ago he gave an exhibition of the results of his a. A temporary line of the ordinary gauge (4 ft. 8½ in.) and about 100 yards in length had been laid down and a car capable of accommodating about 20 persons stood on the metals. The current was supplied in the first instance by a large dynamo machine driven by steam power. In the middle of the tramway track was a third rail with a narrow slot or groove, below which were two half tubes of copper about three inches apart, forming the electric conductor. Within the conductor was placed the collector. The collector moved as the car moved, conveying the electric current to the motor beneath the floor of the car, and the motor as it revolved turned the car wheels. The collector consists practically of two small grooved rollers. The frame holding them has knuckle joints actuated by springs, the effect of which is to keep the rollers constantly pressing against the sides of the conductor, and a good contact is always maintained. From the collector the electric current is carried by two insulated copper wires to the motor. The motor is of the usual pattern and revolves at a high velocity. The power which it exerts is brought to bear upon the wheels of the car through the medium of invert wheels in box gearing, so that the proper speed may be obtained. The wheels are fitted with differential gearing to enable the car to be taken round curves, and for hilly districts it would have a means of ascending steep gradients. The arrangement for steep roads consists, practically, of a large centre wheel running on the middle rail. To guard against the groove filling with dirt a channel would be made several inches below the metals, and at various distances lump holes would be dug. The wheels of the collector would thus regularly clear out refuse into the channel below, and this in turn would be washed into the lump holes, whence it would be easy of removal. Another advantage claimed for the principle is that the car runs as well when the metals are wet as in dry weather, and a shower or two during the trial tested this. The turning of a small handle set the car in motion. The speed varied from six to twelve miles an hour; had the track been larger a still higher speed could have been attained. The car was under perfect control, and, with the assistance of the brake, could be stopped very quickly. To move one car would require about 2½ horse-power, and Mr. Smith estimates that the cost per car mile would be about 2d., whereas now the average cost of running tramcars is said to be 10½d. In the event of the system being adopted for towns there would require to be central stations, one such station serving a distance of about three miles. Of the cost Mr. Smith speaks quite confidently. The system will probably be tried in Southport, and Mr. Smith has also been requested to furnish a small tramway for the Winter Gardens, Blackpool.

A FIERCE ELECTRIC STORM.—Paterson, N. J., was visited by a very fierce electric storm on the 5th inst. The lightning struck an electric light wire and a telephone wire connected with the Court House, and also struck three buildings adjoining. Other buildings suffered in different parts of the city. The Western Union telegraph office was filled with flash after flash, the lightning keeping up a blinding fusilade on the instruments. At the central telephone office every one of the 600 instruments seemed to have been rung up at once, for every shutter in the office fell. The lightning passed off through the arresters to the ground, but many of the arresters were burned out. The fire alarm system was seriously disarranged.

Electric Jewelry.

New York is promised a revival next fall and winter of the gorgeous "old time" ballet, in two or three spectacular pieces, and it is said that the electric light will be resorted to for some of the most striking effects. As considerable interest is being manifested in the subject, we publish three cuts illustrating the electric jewelry of M. Trouvé, of Paris, who has shown great ingenuity in adapting the incandescent lamp to stage and scenic requirements, particularly in diadems and girdles and gems to be worn by footlight sylphs. Perhaps his efforts may stimulate inventors here to experiments in the same line. The description of the cuts was given by the London *Electrician* last month.

The accompanying illustration (Fig. 1) shows various articles of jewelry, each containing a small incandescent lamp, a full-sized sketch of which is appended. No. 1 is a hair-pin; 2 and 3, breast-pins; 4, the head of a cane; 5, a diadem for a tiara; and 6, a large gem, intended to be set

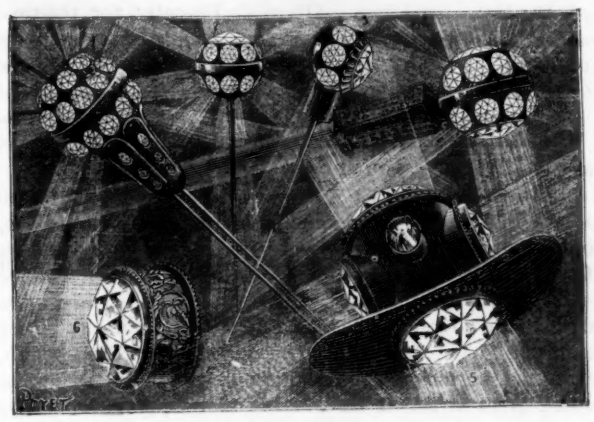
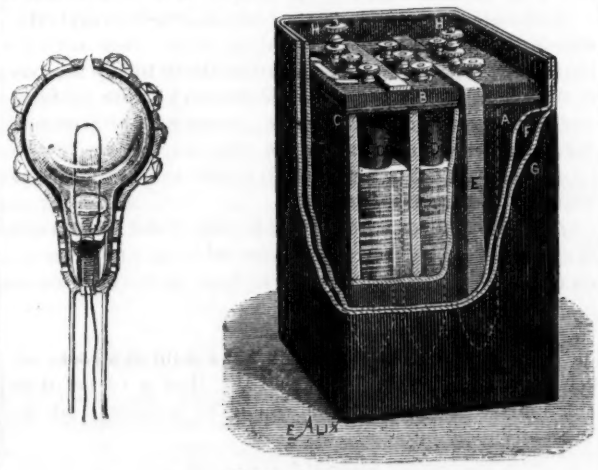


FIG. 1.

in a necklace, for theatrical effects. The leads are inclosed in a small supple cord concealed in the dress, and a switch within easy reach permits of turning the current on or off at pleasure. The practical use that we see in these jewels is that, in returning home late at night, they afford a ready means of brilliant illumination, which would aid in the finding of a lost object, or one's way, and also the way to the key-hole, etc. It is said that the walking-stick, provided with a large diamond, affords sufficient light to read a newspaper by. If set with say a white gem on one side and a red one on the other, it may be used for signaling to a distance, while the switch would enable a communication to be carried on by means of the Morse alphabet.

The neck of the lamp is luted into a small metal collar, so that a new lamp may be readily inserted in case one



FIGS. 2 AND 3.

should break (Fig. 2.) The battery, which is shown partly in section, was last year brought by M. Moncel before the Academy of Science, Paris. The ebonite case *A* (Fig. 3.) is divided by compartments into three cells, two-thirds of their space containing a super-saturated solution of bichromate of potash.

The cover *B*, also of ebonite, carries the elements *D* and *D'* and is attached to the case by two india-rubber bands, *E* and *E'*, a sheet of india-rubber *C* forming a tight joint. To prevent any possibility of the liquid escaping, the whole is inclosed in two thin ebonite covers, *F* and *G*, fitting after the manner of a cigar case. *H* and *H'* are the binding screws for the conducting wires. The duration of incandescence varies nearly in the ratio of the capacity of the battery. The smallest, shown full size in the cut, is capable of maintaining illumination for twenty or twenty-five minutes; while one twice the size, which may be carried by a belt attached to the outside cover, will maintain it for an hour. For theatrical effects of short duration, the size No. 3 will maintain incandescence in eight lamps at once; indeed, as many as twenty-five have been kept going at the same time. The battery can also be recharged in a few minutes by renewing the solution.

Conductivity of Metals and Alloys.

M. Lazare Weiller has conducted a new and independent investigation into the electrical conductivity of certain metals and alloys, the results of which he lately presented to the Société Internationale des Electriciens. For the purposes of his experiments he caused small bars of metal to be cast of a diameter of about 13 mm. (0.51 in.). These were divided in such a way as to show the grain of the fracture, and one part was drawn into wire to be used in the trials. Those alloys which can neither be drawn nor rolled easily, such as silicides and phosphides, were tested directly on the cast bars after the method of Sir William Thomson. In the trials the bars, fitted with binding screws at each end, rested upon knife edges at an invariable distance apart. These knife edges were respectively in communication with two resistances composed of two parts, of which the one was the thousandth part of the other. The extremity of one was connected to the fixed terminal of a Wheatstone bridge with a sliding contact, and the other to the slider itself. The two points which separated the resistances communicated with the galvanometer. Finally the extremities of the bridge were connected to the binding screws by means of a circuit, which included a battery of four elements and a contact key. The resistance sought was then equal to the resistance measured upon the wire of the bridge, divided by 1000. The measurements, which were very carefully and accurately conducted, and were effected on a great number of specimens, were made in part by M. Weiller himself, and in part by M. Duflon, in the laboratory of Messrs. Breguet. The results are given in the following table:

1. Pure silver	100
2. Pure copper	100
3. Refined and crystallized copper	99.9
4. Telegraphic silicious bronze	98
5. Alloy of copper and silver (50 per cent.)	86.65
6. Pure gold	78
7. Silicide of copper, with 4 per cent. of silicium	75
8. Silicide of copper, with 12 per cent. of silicium	54.7
9. Pure aluminium	54.2
10. Tin, with 12 per cent. of sodium	46.9
11. Telephonic silicious bronze	35
12. Copper, with 10 per cent. of lead	30
13. Pure zinc	29.9
14. Telephonic phosphor-bronze	29
15 Silicious brass, with 25 per cent. of zinc	26.49
16. Brass, with 35 per cent. of zinc	21.5
17. Phosphor tin	17.7
18. Alloy of gold and silver (50 per cent.)	16.12
19. Swedish iron	16
20. Pure Banca tin	15.45
21. Antimonial copper	12.7
22. Aluminium bronze (10 per cent.)	12.6
23. Siemens' steel	12
24. Pure platinum	10.6
25. Copper, with 10 per cent. of nickel	10.6
26. Cadmium amalgam (15 per cent.)	10.2
27. Dronier mercurial bronze	10.14
28. Arsenical copper (10 per cent.)	9.1
29. Pure lead	8.88
30. Bronze, with 20 per cent. of tin	8.4
31. Pure nickel	7.89
32. Phosphor-bronze, with 10 per cent. of tin	6.5
33. Phosphor-copper, with 9 per cent. of phosphorus	4.9
34. Antimony	3.88

The resistances are not given in ohms, but as proportions to a given body. They may be reduced to the conventional standard on the assumption that a wire of pure silver, one millimetre in diameter, has, at a temperature of zero Cent. a resistance of 19.37 ohms per kilometre.

Electricity vs. Horseflesh.

The trial trip of the new electrical street car invented by Messrs. Knight & Bentley, late of the U. S. Patent Office, and constructed by the Brush Electric Company, took place on the Garden street line of the East Cleveland Street Railroad Company last Saturday afternoon, says the Cleveland *Iron Trade Review* of Aug. 2. About a mile of the track on the former line, running out New and Quincy streets, had been prepared for the test by the construction of a boxed trench, running between the rails, receiving the two small channel irons, which served as conductors of the electricity. Beneath the centre of the car was boxed the motor, a 15 H. P. Brush dynamo, connected with which were four coil-wires, passing over large pulleys located beneath the seats, thence transmitting the motion to the axle. The action of this lever at the front of the car caused a copper brush, running in the channel, to come in contact with the electrical conductors; the electricity instantly leaped to the dynamo on the car; the armature began to revolve rapidly, and the axles and wheels of the car were propelled forward, at first slowly, at length at a speed of probably five miles an hour, though the inventors claim that from 8 to 15 miles an hour can be obtained. The electricity was generated by a 30 H. P. dynamo, located some four miles away, and conducted to the street car barns on a No. 6 wire. Ultimately, it is the intention, we understand, to locate a full electric power plant at the main stables of the street car company on Euclid avenue.

The results of Saturday's experiments were satisfactory, though, of course, by no means complete. The car, loaded with passengers, made two short trips, running smoothly, rounding curves, and obeying the lever quickly. On Monday much more desirable results were reached, the car being run to Woodland Avenue Cemetery, a distance of about three-quarters of a mile; but by reason of the breaking of some portion of the apparatus it had to be taken back to the barns for repairs. It may be remarked that this piece of track is probably the roughest to be found in the city of Cleveland. Inventors, street railroad officials, and spectators were well pleased with its performance, and the successful completion of this, the first electrical street railway in the United States, will be watched for with much interest by the public generally.

THE
ELECTRICAL WORLD,
PUBLISHED WEEKLY.

W. J. JOHNSTON, - Editor and Publisher.

ASSOCIATE EDITORS.

C. O. MAILLOUX, N. S. KEITH, - - - Scientific Department.
T. C. MARTIN, - - - - - News Department.
CLARENCE E. STUMP, Business Manager.

Mr. Mailloux's articles are marked thus: *₀*. Mr. Keith's thus: □. The Department of Inquiries and Our Illustrated Record of Electrical Patents are edited by Mr. Keith.

Correspondence on all electrical subjects is solicited. Readers are cordially invited to communicate their views and opinions on all topics within the province of this journal. Items of information relating to any application of electrical science will be thankfully received. Our friends will render us a valuable service by forwarding news *promptly* as it occurs, and by mailing us marked copies of their local papers containing anything likely to interest our readers. Anonymous communications not noticed. Rejected manuscript cannot be returned unless accompanied by the necessary postage when received.

THE ELECTRICAL WORLD
HAS THE LARGEST CIRCULATION
OF ANY ELECTRICAL JOURNAL IN THE WORLD.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $2.00.

Postage to any part of the United States or Canada is always prepaid by the Publisher. Addresses changed as often as desired free. Always give the **old** as well as the new address.

ADVERTISING RATES,

Circulation considered, are lower than those of any similar first-class journal. The price varies according to position and number of insertions. Notice of Situations or Help Wanted, $1 to $3 per insertion.

Matter for the Editorial Department should not be addressed to individuals, but solely to

"The Editor of The Electrical World, New York."

All communications relating to subscriptions, book orders, advertising, or of a business nature, should be addressed

W. J. JOHNSTON, Publisher,
NO. 9 MURRAY STREET, NEW YORK.

NEW YORK, AUG. 9, 1884.

THE APPROACHING EXHIBITION.

The International Electrical Exhibition at Philadelphia will open on the 2d of September, barely three weeks hence, and the indications already abound that the efforts of the Franklin Institute to do justice to the development of electrical science and industry will be crowned with the most brilliant success. It is not unlikely that all previous electrical exhibitions will be surpassed in extent and completeness, if only for the reason that every day brings some new application of electricity to art, science, commerce and social convenience, and that a great deal has been accomplished since the exhibitions of London, Paris, Munich and Vienna in perfecting old inventions.

Our readers will be glad to hear that work on the buildings is practically finished. In the plans that were made originally and illustrated in these columns, no less a space than 200,000 square feet was rendered available for exhibition purposes; but it has been found necessary to make an addition of 28,000 square feet to the north and south galleries. It is not a little amusing to note how anxious people are to get into the exhibition with their various inventions when they find out that by procrastination they have virtually forfeited their chances of doing so. We have met not a few such laggards within the last week or two, and we are not surprised to hear that the different committees are besieged with applications for space up to the present hour. In some instances, where an important invention has barely been worked up into practical shape, as with the Cleveland Electric Motor Company, now applying for space, there is an excuse for tardiness. As the directors of the exhibition wish to make it as comprehensive as possible, they have tried to be as lenient and generous as their limited space will allow.

Some of the exhibits undertaken by the managers themselves appear to us to be very happily chosen. One feature of novelty, for instance, will be the "dark room," and the very name ought to set the hearts of the children pit-a-pat with interest and curiosity. We venture to think that it is a good thing thus to tempt the juveniles to ask questions about the Geissler and Crooke tubes, Rhumkorff coils, and other apparatus that will be shown in the electrical "chamber of horrors." Prof. Edwin J. Houston, too, has also hit upon an excellent idea. He is at work, we learn, upon huge maps to be painted in distemper on the walls of the lecture-room in the Pennsylvania depot, showing the location of all the ocean cables in use, projected or abandoned. Two of these maps will be stereographic projections of the world, drawn with a radius of 20 feet, one projected from London and the other from the antipodal point. A third map, of the world on Mercator's projection, will be 40 feet by 60. These maps, in connection with which, perhaps, Mr. F. N. Gisborne's admirable series of cable charts issued by the Government of Canada, might be used, will afford to every one a good opportunity of ascertaining clearly the nature and extent of submarine telegraphic operations.

It is matter for congratulation that President Arthur has made so judicious a selection of gentlemen to serve as members of the Commission to conduct in the name of the Government a national conference of electricians in connection with the Exhibition. Mr. Frelinghuysen, Secretary of State, has every justification for his remark that "this Commission, appointed for high scientific purposes, will not permit its influence to be exerted in behalf of any person, or company, manufacturers of electrical apparatus or machines." We may look for most valuable work from the commission, and the native and foreign electricians to be associated with it, in its inquiries and investigations.

THE REPRESSION OF TELEPHONY IN ENGLAND.

It is evident that a storm of indignation is brewing in England against the Postal authorities for their action in repressing telephony. Our exchanges from the other side show by their news and comment that the policy pursued cannot be much longer persisted in without serious harm to the administration. Allowing liberally for political animus in some of the complaints, the facts brought to light are but too plainly indicative of a desire or intention on the part of the authorities to favor the Government telegraphs at the expense of the telephone. The *Western Morning News* of July 17 speaks out bluntly on the subject as follows:

"Much was hoped from placing so able and enlightened a statesman as Mr. Fawcett at the head of the Post-office, and proportionately great is the disappointment at finding that in the matter of the telephone and telephone exchanges there is nothing but procrastination, repression and narrowness, resulting in financial failure and public inconvenience. In Plymouth, Devenport and Stonehouse, three years ago, there were 150 residents each of whom could speak to the other through a telephone exchange. But official pique on the part of the Post-office put a stop to this, and established a so-called Post-office exchange. The number of members has never exceeded forty-six, it has now fallen back to forty-two, and several other subscribers have given notice to leave unless the numbers are so increased as to make the exchange really worthy of the name. Plymouth is but a sample of nearly every other town where the Post-office monopoly has taken effect, and Post-office Exchanges have been instituted. But for the Postmaster-General's veto, a real and useful Exchange might be established in the three towns next week, at a subscription far less than that which the Post-office demands. The Liberal Government protests against obstruction in Parliament, but itself practices it all over the country."

Similar language about similar cases may be easily found in scores of English newspapers, and we trust the occasions for it will soon be wanting, by resort to efficient remedies.

Meanwhile, in spite of all its troubles, the United Telephone Company, like some vigorous plant over which a big stone has been put in vain, contrives to lift its head and to fling out healthy feelers. The revenue of the company during the past year was $460,000, against $320,000 last year. The number of subscribers to its own exchanges has increased from 2,745 to 3,350, and it is able to declare an 8 per cent. dividend. This is cheering, and will no doubt encourage the company to persevere until, freed from restrictions, it and the companies licensed by it are able to confer on all England the benefits of telephony as they are known in America.

THE ELECTRIC RAILWAY EXCITEMENT.

Within the last few weeks a wonderful development of public interest has been shown in the subject of electrical railways in this country. That, the electrical transmission of power generally, and the subdivision of currents for conversion into mechanical energy for shops, factories, etc., are attracting very widespread attention. Our own columns to-day furnish significant evidence in regard to the absorbing nature of the matter. We reproduce from four of the leading papers four interviews had by their respective reporters with Mr. Edison, Mr. Daft, Mr. Stephen D. Field and Col. Rowland R. Hazard, the last of whom may perhaps represent the Knight & Bentley interests in the electric tramcar road now working so successfully at Cleveland. Each of these statements is important, and we have no doubt they will be read carefully and critically by our readers.

The truth is that the electric railway is an accomplished fact, and that here in America we have been remarkably slow to appreciate the meaning of the fact. Before long, however, we shall have caught up to European electricians in this department, and it will be strange if, as heretofore, our inventors do not strike out in new and profitable directions in the transmission of power for this as well as for other purposes. We do not pretend to be able to gauge the full importance of Mr. Cyrus Field's language at the meeting of the shareholders of the Elevated roads last week, but we know that Mr. Field pushed the first ocean cable enterprise to success, and that he is a man of deeds as well as of words. He said: "The city will grow in the direction of the best facilities for travel, and these we propose to give. In Europe, elevated roads are to-day operated by electricity. I trust that the day is near when we can reduce our operating expenses materially by substituting electricity for steam as our motive power." Then, too, there is the scheme for an electric underground road for Broadway, and we have never heard of a plan bolder in outline or more feasible and practicable when studied in detail. It is a plan of which more will soon be known, and one, too, of which when carried out New York will fairly be proud.

THE DANGERS OF GAS.

Little has been heard of late about the dangers of electric wires, probably because the persons who invented the stories current last spring have reached the limit of their imaginative faculties or have been shamed into habits of truthfulness. But while the papers have been silent as to accidents resulting from the use of aerial wires, they have teemed with paragraphs relating to accidents from the use of gas. We counted four items of that kind in a single issue of one daily paper in July, and since the beginning of August the number of instances in which life and property have suffered from gas accidents has run up to at least a dozen. One of the latest is the destruction of the fine depot of the Pennsylvania Railroad at Jersey City. For some weeks past a strong odor of gas had been noticed near the ticket office there, and it became stronger yet about the 4th inst. At 11:30 P. M. on that day, as a lady went into the office to buy a ticket, a loud explosion occurred under her feet and she was thrown out upon the sidewalk, while the ferry-master, standing near, was hurled six feet in the air. It was not long before the flames spread by the exploding gas had enveloped the whole building, and in a few hours property worth hundreds of thousands of dollars had been destroyed. Several persons were injured in the fire, and travel was seriously impeded. More damage was done, and more trouble was caused, by that one explosion of gas, than by all the accidents from electric wires that have been made much of during the last twelve months. The rebuilt depot will, it is said, be wholly lighted by electricity—a wise precaution against further fires.

NEW INVENTIONS WANTED.

Mr. Edison announces that he is going back to original inventing and will produce a new crop of inventions in the electrical line very shortly. We felicitate Mr. Edison upon this decision. For fertility of resource and suggestion he has had few, if any, equals, and he is best employed when seeking to learn from nature all that she is willing to reveal or all that he can wring from her and turn to good account for humanity. He is one of the men, too, who have always a back country to draw upon, prairie to break up with the plow of research, and rich land to pre-empt. While others, exhausted with their efforts, fall back, believing that the possibilities of discovery have been exhausted, he presses on for new conquests.

Of course there are new discoveries to be made in electricity. It was Archbishop Whately, we believe, who remarked that the larger the circle of light, the greater was the darkness revealed beyond, and in the same way every electrical invention is a revelation of other and vaster regions awaiting investigation and exploitation. To descend from the general to the particular, we may state that a correspondent inquired of us this week for an electrical invention that will enable him to protect his hencoops from nocturnal depredations. Will Mr. Edison, like a giant refreshed from his slumbers, turn his thoughts first in this direction, humble though it be?

The Brush Patents.

With regard to the decision of Judge Shipman in the suit brought against the United States Company by the Brush Company, already noted in our columns, and referred to by Mr. Leonard E. Curtis, Secretary of the former company, in a letter published by us, the Brush Company have issued the following important circular:

It will, no doubt, surprise our agencies and lighting companies to learn that a suit of this company against the U. S. Electric Lighting Company, which has been before the Court for a long time past, has been decided by Judge Shipman in favor of the defendants. The decision was a great surprise to us, and we have every reason to believe it was fully as much a surprise to the defendants. There were a number of intricate points in the case over which great labor was spent by both sides, all of which were decided in our favor, and the case finally turned on a single point, which was a very simple one, and we suppose entirely clear. In 1876, two years prior to the date of Mr. Brush's patent, a man named Hayes made a lamp containing a clamp somewhat resembling the clamp used in the Brush lamp, but used quite differently. The lamp was a failure, and after a number of attempts to make it work properly, the clamp was taken off, thrown into a scrap box, and the whole matter dropped. No other lamp was ever made with the clamp, and as this one had never been regarded as successful, either by the maker or any one else, until it was thought that it could be made use of to beat us, and was, as we believed, purely experimental, we treated it as an abandoned experiment, and, therefore, no anticipation of Mr. Brush's invention, which was entirely successful from the start. Judge Shipman decided, but apparently after serious doubt, that it was not strictly an abandoned experiment, and on this point alone decided the case against

us. The case will be at once appealed to the United States Supreme Court, and followed up to the end.

The only issue involved in the final hearing of this suit was the lifting and feeding clamp in the lamp. We have other suits still pending against the agents of the United States Company, or users of its apparatus, on other patents that are of much more importance than the one recently decided. We also have a number of other suits on various patents against other systems of lighting, as will be seen by the accompanying list, and infringers will do well to bear in mind that so far only a single one out of more than forty Brush patents has been judicially declared invalid, and we propose, as heretofore, to prosecute all infringers who disregard our rights.

Suits are now in progress in various United States Circuit Courts against users of infringing apparatus covered by patents other than the one passed on by Judge Shipman. Among these are suits against users of the following systems: The United States (Weston); the Fuller Electrical Company; the Excelsior Electric Light Company (Arnoux & Hochhausen); the Schuyler Company; the Van Depoele Company; the Boulton Carbon Company; the Pittsburgh Carbon Company.

Suits are also in preparation against other infringers, including the Thomson-Houston System, which infringes some of our most important patents upon the dynamo machine. The above suits include many different patents, all of which are controlled by us.

Electrical Information for Beginners.

BY WM. MAVER, JR.—PART VII.

Electro-Magnets.

When a current of electricity is passed in the same direction through two pieces of wire lying parallel to each other, as in Fig. 19, the magnetic circles generated in each of the wires *A* and *B* coalesce, as it were, and form one large circle; and if the wires were placed so that they could move freely, it would be found that they would be attracted to each other. On the contrary, when a current is passed through two parallel wires in different directions, as indicated in Fig. 20, the magnetic circles repel each other, and if the wires *A* and *B* were now also placed free to move, they would repel each other. A wire coiled as in Fig. 21 is called a helix; when a current is sent through it

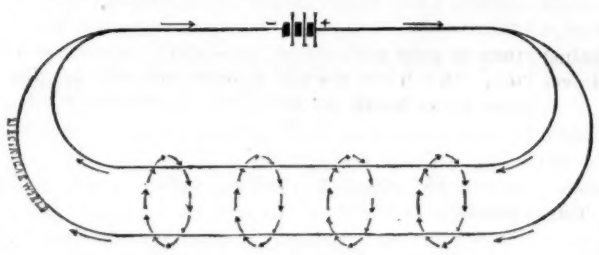


FIG. 19.

and it is supported at the points *S* and *S'*, so that it may move freely, it will assume a position pointing north and south, in the same manner as a magnetic needle. It will also manifest all the other phenomena of a magnetic needle. For instance, it will be repelled or attracted by the north or south pole of a magnet, according to the direction of the magnetic circles. This we can prove by arranging in the circuit an instrument known as a pole-changer, *P C* in the figure.

The function of a pole-changer, as its name implies, is to change the poles of a battery with relation to a wire or circuit. In Fig. 21 the keys *K* and *K'* of the pole changer *P C* are pressed against the upper cross-bar *U* by springs underneath them, so that in its normal condition the battery *B* is open; the lower bar, to which its negative end is attached, being disconnected from the keys *K* and *K'*.

I may say in passing that these thick and thin lines at *B* are the conventional symbols for a battery. The long thin lines represent the positive pole of the battery, the short thick line the negative pole.

The direction of the current is always said to be for convenience *from* the positive pole, as indicated by the arrow in the figure.

When we depress key *K*, we detach it from the upper cross-bar *U*, and cause it to touch the lower bar. This, it will be seen, forms a complete circuit, with the current flowing as shown by the arrows.

The current thus produced generates magnetic circles of a certain direction. Let us suppose that they are such as to cause an attraction between the *N* pole of the magnet *M* and the *S* pole of the helix. Now, we allow key *K* to arise, and depress *K'*. *K'* therefore leaves *U* and connects with *L*. The current now flows from the battery to key *K*, to the helix, in an opposite direction to that shown by the arrows. This changes the direction of action of the magnetic circles, and it will now be found that the *S* pole of the helix is repelled by the magnet.

If now we should form a helix by winding a piece of insulated wire (that is, wire covered with an insulating material such as cotton or silk) around a bar of soft iron, we shall find that the magnetism generated by a current is much increased, for the reason that the iron concentrates the most of the magnetic lines of force within its own substance, as was shown and explained in Fig. 16. Fig. 22 also shows very clearly by means of the iron filings the result of so winding a wire.

The bar and coil in this figure are now termed an electro-magnet.

The bar is generally called the core, the surrounding wire a helix.

The core is nearly always composed of soft iron, because the latter is much more susceptible of magnetism than hard iron or steel.

Steel may be magnetized by a strong current of electricity, but in such a case it retains its magnetism, and is then

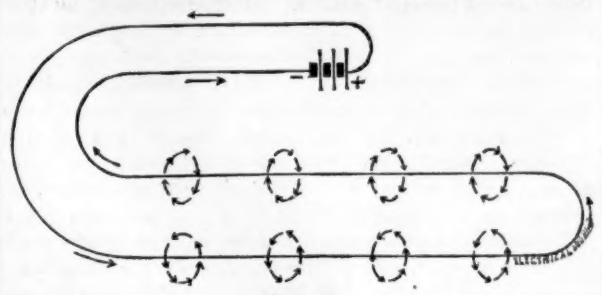


FIG. 20.

called a permanent magnet. On the contrary, soft iron loses its magnetism immediately upon the cessation of the current in the helix.

This property of soft iron is availed of to a great extent in telegraphy. For instance, in the case of relays and sounders. The circuit is made by closing a key. A current of electricity is set up in the wire and in the helix, which magnetizes the core. The core induces electricity in the armature of the instrument, which is thereby attracted in the well known way. The key is again opened, the core loses its magnetism, and the spring of the armature withdraws it from the core.

The direction of the current of electricity in the coils around the core determines what is termed the polarity of the magnet; that is, again referring for an example to the helix in Fig. 21, as we find that, while the current is flowing through the coil, as shown by the arrows, it is attracted by the north pole of a magnet, we say the end of

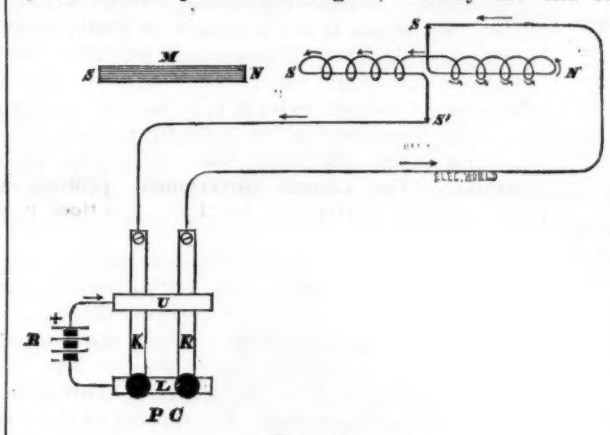


FIG. 21.

the helix pointing to the magnet has a south or south-seeking polarity; the other end of the helix must then have a north polarity.

Now, if we should look at a certain end of a magnet and should cause a current to flow around the coils surrounding the core from left to right, the end at which we are looking will have a south-seeking polarity. Reverse the direction of the current, and the end at which we are looking becomes a north pole. Fig. 2 showed very plainly the polarity of an electro-magnet with the current in a certain direction.

This feature of an electro-magnet is also extensively utilized in telegraphy by the aid of a pole-changer in the following manner: One pole of a permanent magnet, Fig. 23, is placed between the ends or poles of an electro-magnet in such a way that it may move from one end to the

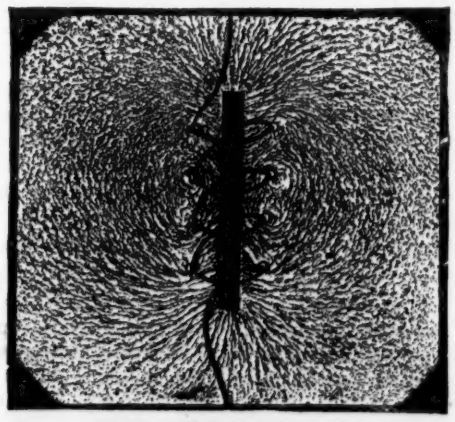


FIG. 22.

other; then, if the current be sent through the coils in one direction, the permanent magnet will be attracted to the unlike pole of the electro-magnet and repelled by the like pole of it. Now, if the direction of the current be changed, it will change the polarity of the electro-magnet, and, consequently, the permanent magnet will change its position. A relay prepared as above is known as a polarized relay.

When we have a current of electricity of a given strength in the helix of an electro-magnet, the strength of the magnetism generated in the core will be in proportion to the number of convolutions of wire, up to a given point, for there is a point at which the core becomes saturated, as it is called, with magnetism, and after that point has been reached, neither the addition of more coils nor an increase in the strength of the current surrounding the core will increase the magnetism.

I have already stated that the strength of the magnetic circles generated in a wire through which a current is flowing decreases as they are removed from the centre.

From this it would appear that the inner convolutions of a helix would have much more effect upon the core than the outer turns, but it is not the case to any appreciable extent, inasmuch as the greater length of the outer turns compensates for their greater distance from the core. For, as the magnetic circles emanate from every portion of the wire, it is evident that the longer the wire the greater the number of lines of force that penetrate to the core.

Electro-magnets are the strongest kind of magnets, and their attractive power can be made very great.

The Stevens Institute has one of the largest electro-magnets in the world. A man can stand with his back against one of the poles of this magnet, and one end of a large iron chain link placed to his breast will suspend by the induced magnetism in its further end another link of equal size, probably weighing five or six pounds.

I have also seen large iron spikes held by a string wavering in the air between the poles of the same magnet, like a kite in a gale.

(TO BE CONTINUED).

The Bartholdi Statue of Liberty.

The corner-stone of the Bartholdi Statue of "Liberty Enlightening the World," given by France to the United States, was laid at Bedloe's Island, in New York Harbor,

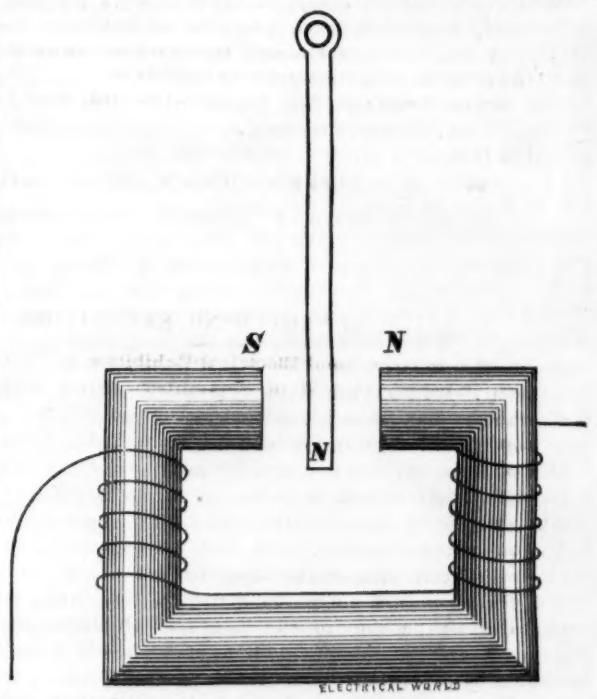


FIG. 23.

on August 4. The intention to light the statue by electricity was referred to at length in these columns on April 26. The pedestal proper will be 114 feet high, and will stand on a high terrace of the island. The height of the statue from its base up to the top of the torch is 151.14 feet. In the course of his oration Mr. William Allan Butler said:

"It is proposed, as I understand, that the torch to be uplifted in the hand of the Statue of Liberty shall receive its illuminating power from an electric light. This wonderful gift of science to mankind is the crowning result of the electrical researches and experiments which Franklin initiated by the bold and simple and successful methods which placed him in the front rank of experimental philosophers, and secured for him the congratulations of the French King Franklin believed in the sincerity of the French people, he attested the vast and inestimable worth of their aid, and declared over his own honest hand that they 'expected no return but that of gratitude and friendship, and these,' he adds, 'I hope may be everlasting.' These words, which he wrote to Robert R. Livingston more than a century ago, are the groundwork of the thoughts I have briefly and imperfectly expressed to-day. The hand that wrote them is in the dust, but the sentiments they embody and the wish they breathe are imperishable and will be perpetuated in the enduring monument for which this solid resting-place is preparing. And when, from the beacon which crowns it, shall shine forth the electric light, the consummate fruit of labors in which Franklin was the pioneer, wrought out to perfection by patient toilers who followed in the path in which he led, it will be indeed a fit emblem of the torch of Freedom, kindled by a celestial spark, guarded and kept alive by heroic service, and at last lifted up to the safe and serene height—a light to lighten the world."

NEW CORPORATIONS.—During the last week of July new corporations were reported as being formed throughout the country, with a capital of $1,100,000, for electric lighting. The business is "picking up" in a very healthy manner.

A Method of Testing Iron and Steel by Magnetism.*

BY G. M. ROSE, C. E.

I think that possibly it is now well known to engineers and others that it is a most difficult and often impossible thing to find out the existence of a false weld in a forging, or a blow-hole or honeycomb in an iron or steel casting. The only safe way I have found of doing this is to carefully measure the elongation of the piece under a given load, as with a false weld all the work is thrown on the diminished area at the defective weld, and the thicker parts are scarcely extended by the force which is perhaps rupturing the bar at the flawed spot. I need scarcely note that there are many important cases where this process, or the equivalent, but dangerous one, of trying the effects of an impulsive force, could neither be mechanically nor commercially practicable. Most practical men will agree that a simple method by which internal flaws and solutions of continuity in constructive details could be easily detected, would be of enormous value to the world. Such a method has undoubtedly been discovered, and I have used it in several places where I have been producing steel for forgings, castings, etc. Though comparatively little known, or, if known, not applied, the process will possibly have a yet more extended application than finding out only mechanical flaws in irons, cast irons and steels.

The principle upon which the method is founded is so simple that it certainly seems strange that it had so long escaped notice. It has been known for nearly a century or more, that when a bar or any mass of soft iron is placed in the position of the dipping-needle, it is at once sensibly magnetic, the lower extremity being a north pole in our latitudes, and the upper extremity a south pole. In the southern hemisphere the poles are reversed. The same action, only weakened, takes place in a bar hanging in a vertical or any other position, only the effect is weaker the more the position of the longitudinal axis of, for instance, a long bar departs from that of the magnetic dipping-needle. When, therefore, a small compass-needle is slowly passed in front of a bar of very good homogeneous iron or steel, placed in an east and west direction, the needle will not be disturbed from its proper direction, which is, of course, at right angles to this—or north and south. All this refers to regularly homogeneous bars of best quality—to bars without any mechanical solutions of continuity. With internal flaws or interruptions of continuity the bar is no longer regularly magnetic. It has long been known that a good compass-needle, or a good permanent magnet, must be homogeneous and without flaws in order to take and retain its maximum amount of magnetism. In a word, any mechanical solution of continuity is accompanied with a polar solution of continuity; and the given bar or mass with flaws—whether permanently magnetized or temporarily so by the inductive action of the earth—is no longer one regular magnet, but several different magnets, with the different magnetisms separated from each other. The delicately-poised magnet of a compass can thus be made to tell the presence of such solutions of continuity. The amounts of the temporary disturbances are of course measured by the number of degrees the needle was deviated. The bar of metal can first be tested in the magnetic equatorial plane, and certain disturbances of the needle may show themselves, indicating internal faults; and on turning the bar end for end, but still in the magnetic equatorial plane, the same deviations will occur, pointing to the same faulty spots. With the bar lying on the magnetic meridian the needle will be similarly deviated, though the indications thus obtained would evidently not be so practically clear and easily obtainable as when the bar was in the magnetic equatorial plane. Up to the present I have heard of but one experiment with steels of various qualities since I was using the method, and only a few with cast iron, but those my friends have made, they inform me they have found satisfactory. Any difficulty that might be supposed to attend the presence in metal of what astronomers term supermanent magnetism, is easily overcome. A few taps on the end of the bar, when lying east and west, sufficient to cause vibration, would demagnetize it and leave it in a fit state to be examined by the needle; any polarity subsequently found would indicate either a steely nature of the bar or inferior iron. At first sight it might be believed that, as almost any flaw will cause a disturbance in the compass-needle, it would be difficult to tell a serious solution of continuity from a small crack. But this is met by the obvious reflection that the range or distance through which the needle is disturbed must be taken into account. On reflection it will be noticed, however, that an object rather short in relation to its diameter is more difficult to try than a long bar.

Some brief considerations will determine the value of the method to engineers, whether for trying new work of all kinds or even working details in a suspicious state.

In estimating the value, in the widest sense of the term, of any bar, forging, etc., three qualifications may be considered as governing: (1) Its limit of elasticity, or the amount it will yield in any given direction without taking permanent set. (2) Its ductility, or the permanent alteration it will take before actual rupture. (3) Its ultimate resistance, or amount of the load it will stand per original unit of cross-sectional area before actual rupture. These three qualifications in a complete forging are evidently: (1) Defective welds, or large solutions of continuity in the mass. (2) The absence of smaller flaws or solutions of continuity—either due (1) to the presence of scoria or slag either parallel or across the longitudinal axis of the bar, or (2) to cracks, often unsuspected, caused in the working when portions of the forging are too cold, or (3) to actual separations at the facets of the elongated crystals of which the iron always consists, and due to loads of whatever kind beyond the elastic limit. (3) The chemical constitution of the bar—such as its freedom from phosphorus, sulphur, arsenic, silicon, manganese, etc. (apparently everything but carbon in small quantities), originally governing its mode of crystallization, and hence more or less its elasticity, ductility, and ultimate resistance to rupture. Now this method can detect the presence, and negatively of course the absence, of small or large solutions of continuity. It can detect false welds, smaller flaws caused by bad workmanship or wear, and, I believe, also what is commonly called "crystallization," which will probably soon be generally acknowledged to consist in a disruption or parting of the facets of the amorphously arranged crystals of which the metal is built. It can only detect the results of the chemical constitution of iron, as evidenced in the less perfect cohesion of the crystals when alloyed, in relatively considerable quantities, with foreign bodies. There is little doubt that the magnetic method is a test of the homogeneous character of the metal, and of its freedom from fissures and cracks, and so far it undoubtedly forms a test of quality. Perhaps to some of your many readers it will appear scarcely credible that a common pocket-compass needle should be able—almost like the divining-rod said to be used for finding metals, water, etc.—to discover important concealed defects in large or small metal bars. A mere statement of the fact does seem almost incredible until the simple means actually employed are explained. In a future communication I shall be pleased to give some details of those past experiments, perhaps also coupled with tests of steels and irons produced in the district of Chicago.

*Industrial World.

Disque Leclanche Battery.

The "best battery" question has always been one of leading interest with telephone exchange managers, and we have no doubt that a great many of them will be glad to have their attention called to any device that promises the desired results. The cut given below represents the

DISQUE LECLANCHE BATTERY.

Disque Leclanché battery, now furnished by J. H. Bunnell & Co., of 112 Liberty street. With this form of battery telephone companies are already to some extent familiar, though preference has been displayed for the prism form on the score of economy. The claim of the firm now is that the merit of cheapness rests with their disque type. As the profits of working telephone exchanges appear to lie at present more in what is saved on running expenses than in additions to the list of subscribers above a certain number, it may be well to present the claim made for this battery, as follows: "The Complete Disque Cell is furnished, in quantity, for the price of a single pair of prisms, while instead of requiring renewal once every four to six months, the Disque Porous Cup does first-class transmitter and bell work for from 18 to 30 months. The renewal of the porous cup costs but little more than half the price for prisms. These great advantages in price and durability are calculated to produce important results on the dividends from any telephone plant, especially if it has several hundred transmitters in use. A number of the largest telephone companies in the United States have already availed themselves of this plain advantage and are using this Disque Battery exclusively. Now that the Disque, which is the foundation sal ammoniac Battery and the best of any or all, has also become the cheapest, there can be no question as to the entire economy of its use above all others."

National Electrical Commission.

The Commissioners appointed by the President of the United States, under the authority of an act of Congress to arrange for the calling of a national Congress or Conference of scientists upon electricity to meet in Philadelphia during the International Exhibition, held their first meeting on Thursday morning in the hall of the Franklin Institute.

There were present Professors H. A. Rowland, J. Willard Gibbs, E. J. Houston, George F. Barker, M. B. Snyder, John Trowbridge, C. A. Young, Simon Newcomb, Francis Vandyke, and Dr. W. H. Wahl. The absentees were Professors Brackett and Fisher. An organization was effected by the election of Professor Rowland as President, Professor M. B. Snyder as Recording Secretary, and Professor George F. Barker as Corresponding Secretary.

The Commission was in session, with closed doors, for nearly three hours, discussing matters relative to the organization of the Commission and the contemplated organization of the Conference or Congress. The Commission will not be able to get through with the business for several days.

A Moonlight Excursion.

The second annual moonlight excursion of the New York and New Jersey Telephone Company was given on Tuesday evening, August 5, and proved a most successful and delightful outing, thanks to the plans carried out by the Committee of Arrangements, consisting of General C. H. Barney, Mr. J. C. Reilly and Mr. T. B. Perry.

Among those present were: C. F. Cutter, Prest.; Joel C. Clark, Treas.; W. D. Sargent, Gen. Man.; T. B. Perry, Audr.; General Barney, Supt. N. J. Div., and J. C. Reilly, Supt. Long Island Div. In addition to these there were present the staff of the general office, the exchange managers and the operators of both divisions, numbering in all about 200. The list of visitors included Major Franklin Allen, representing Mayor Low; W. N. Estabrook, of the N. Y. & Pa. Co., Elmira, N. Y.; H. L. Stork, C. E. Gough, L. M. Goddard, Robert Morton and about 50 others well known in connection with the telephonic and telegraphic interests. Telegrams of regret at absence were received from officers of the American Bell Company, and from other prominent gentlemen who had desired to be present but were kept away by the inclement weather.

The party started from Jersey City and Jewell's Wharf, Brooklyn, on board the steamer "Magenta," Capt. E. Carman, and got clear away about 7:30. The steamer went up the East River, down the Bay and up the Hudson for some distance, returning home in time for the midnight trains. The dancing, with a programme of twelve pieces, continued until the vessel returned, and was greatly enjoyed by all present who participated, as well as by those who looked on. The moon was obscured throughout the evening, but this did not affect the spirits of the party in the least. Refreshments were liberally provided. Speeches were made in a happy vein by the officers, and by Major Allen, who complimented the management and force on the rapid growth of the business and very efficient service rendered. He humorously traced the growth and efficiency to the fact that about ninety-nine in every hundred of the employés of the company were ladies. Mr. Clark, the treasurer, gave a highly enjoyable speech in rhyme, descriptive of scenes in telephone exchanges. All the points were well made and fully appreciated. Much of the success of the evening was due to the activity of Mr. John F. Noonan, of the Paterson Exchange, who officiated as floor manager, assisted by Messrs. McCully, Lindsley, Quinn and Crawford. Excellent music was furnished by Lander's orchestra.

The subscribers in the territory of the company now number 4,300, and are rapidly increasing despite the dull times. All exchanges are connected by trunk lines, and with New York city as well as a large area of surrounding country. Any subscriber can reach not less than 10,000 others within a radius of from forty to fifty miles, and about 8,000 of these are inside a radius of twenty miles.

The Electric Light in England.

The London *Engineer* has the following: "Although no more is heard of the formation of companies and huge undertakings for lighting whole cities, electric lighting continues to make steady progress. It is impossible to see the magnificent display at the Health Exhibition without feeling that a system of artificial illumination which can do so much must be independent to a large extent of the success or failure of mere speculators. It is beyond all question, we think, that the electric light has a great future before it, and the fears which have been expressed that it must fail to meet with popular approval may be dismissed as of little or no moment. The course of events during the last few months in connection with electric lighting may be very easily stated. In incandescent lighting no important improvement of any kind has been introduced—we do not now refer to means of generating or distributing current, but to the lamps. It would seem, indeed, as though finality in this direction had been reached; lamps of very high resistance are in the market, and the durability of lamps all round seems to be fairly

satisfactory. Whether it is or not, however, there is no evidence to show that better lamps can be produced than those now made. It is possible, of course, that improvements may be effected, but it is at least very doubtful. It is a noteworthy fact, moreover, that arc lighting is coming daily into more efficient rivalry with the incandescent system, and justly so. Let our readers who visit the Health Exhibition contrast the lighting of the great hall by star lamps along the roof with the lighting of courts where arc lamps of really good quality are employed, and we think that it will be impossible to avoid the conclusion that the arc has the best of it. Nothing, for example, can excel the tempered glory of the sun lamps in and about the water companies' pavilion, but there are other arc lights to be seen which are quite equal to them. For domestic lighting nothing exists at present equal in quality to the incandescent lamp, but it is open to question whether it may not meet with a rival of importance even in its own special province. Long since we have pointed out that it might be found quite possible to produce arc lamps of small size which would answer admirably for domestic lighting. Those who remember the first Werderman lamp, in which a small pencil of carbon was pressed against a disc of the same material, know that a step was made in the right direction. Messrs. Siemens are now, we understand, pushing further on this road, and producing a little arc lamp which works with a current of about two ampères. For large, or comparatively large, buildings arc lighting is matchless, and arc lamps are now made by Crompton, Brockie, Bowman and others, which leave nothing in this respect to be desired. Much of the success which has been achieved in arc lighting is due to the improvement which has been effected in the manufacture of carbons, an art still kept a secret, and by no means yet brought to the perfection of which it is capable."

The Outlook for Copper.

It appears from official tables, says the *Age of Steel*, that the product of the Lake Superior copper mines for the months of April, May and June is considerably larger than for the corresponding time in 1883. Since January 1st., the production of mineral has been 19,334 tons, as against 16,441 tons for the first half year of 1883. Calumet and Hecla shows an increase from 10,125 to 12,301 tons.

Last year the lake mines produced about 60,000,000 pounds There is good reason to expect that this will be increased to 70,000,000 in 1884. It must be remembered, too, that this represents the output of our Lake Superior mines alone. Arizona is counted on to produce this year 20,000,000 pounds, Montana 4,000,000, Missouri and other places not included in above, 2,000,000. In the aggregate, therefore, the amount of our copper product for the year will not be far from 100,000,000 pounds. Where is the enormous amount to be marketed? The great producers in all parts of the world are struggling for its markets. The consumption of the United States is not far from 78,000,000 pounds, and 10,000,000 pounds of lake are already contracted for abroad. This leaves a balance of over 10,000,000 pounds which must be a constant drawback to any improvement in values.

An Arizona correspondent of the San Francisco *Exchange* writes: "I learn that the famous Copper Queen mine of Bisbee has just been sold to an English syndicate for $1,250,000, cash. Notwithstanding the low price of copper the new purchasers are sanguine of success, claiming, with reason, that they can produce the metal cheaper than it can be turned out anywhere else in the world. The ores of this mine are remarkably free, consisting near the surface of a crystalline mass of green carbonate of copper and calcite, mixed with peroxide of iron and manganese, while in depth the prevailing ore is a friable clay permeated with about 12 per cent. of copper as carbonate. The ore furnishes its own fluxes in the shape of calcite and limonite, and this gives it a great advantage over sulphureted ores, which must be heated with great economy and skill to be at all profitable. It is stated by persons familiar with copper production that the Copper Queen mine can make money with copper at 3 cents per pound. The present price is 13½ cents. The ores of the great copper mine of the lake region—the Calumet and Hecla—average only 3 per cent., and require stamping and concentrating, and it is said that this mine cannot make the metal under 10 cents per pound. Copper generally occurs in the Arizona mine in the form of green and blue carbonates and red and black oxides. The ore can be melted at small cost, while to work a mine of unaltered sulphureted ores requires a large outlay for machinery, roasting, furnaces, etc."

The British Association Meeting in Montreal.

With reference to the coming meeting of the Association at Montreal, the London *Times*, in an article upon the subject, says that, in the case of some of the railways, notably the Canadian Pacific, the free traveling for members began on July 1. The exact number of those who have received vouchers for Canada is 852; of these about 560 are old members, and it may confidently be expected that the actual attendance at the meeting will be quite up to the average. The greatest precautions have been taken that those who have the advantage of the privileges granted by the committee and by the liberal Canadian Government, shall make legitimate use of them. We regret to learn that Sir Joseph Hooker will be unable to attend the meeting, although he was nominated one of the vice-presidents by the committee. Mr. W. H. Preece will take the place of Mr. Westmacott as a vice-president of Section G. Among those to whom vouchers of membership have been issued, we notice the names of the following: Prof. J. C. Adams, of Cambridge; Prof. W. G. Adams, of King's College; Mr. John Ball; Prof. R. S. Ball, Astronomer Royal for Ireland; Mr. W. T. Blanford, of the Indian Geological Survey; Sir Frederick Bramwell; Mr. W. Carruthers, of the British Museum; Prof. G. H. Darwin, Prof. Boyd Dawkins, Prof. James Dewar, Sir Frederick Evans, Dr. E. Frankland, Captain Douglas Galton, Dr. J. H. Gladstone, Mr. James Glaisher, Mr. J. W. L. Glaisher, Colonel Godwin Austin, Sir J. H. Lefroy, Dr. Leone Levi, Sir John Lubbock, Prof. H. N. Moseley, Admiral Sir E. Ommanney, Rev. S. J. Perry, Captain Bedford Pim, Right Hon. Sir Lyon Playfair, Lord Rayleigh (President), Prof. Osborne Reynolds, Prof. Chandler Roberts, Prof. Sir E. Roscoe, the Earl of Rosse, Prof. Burdon Sanderson, Mr. Trelawney Saunders, Mr. P. L. Sclater, Mr. R. H. Scott, Sir Richard Temple, Sir William Thomson, Dr. E. B. Tylor, Mr. H. Trueman Wood. The local committee is making the most strenuous efforts to make the meeting a success. It appeals to the public spirit of the citizens of Montreal, and the *Times* believes the appeal has been liberally responded to. It is confidently expected that from five to six hundred persons will be received as guests into the houses of the inhabitants during the meeting of the Association, while a sum of not less than $10,000 will be placed at their disposal by the citizens to enable them adequately to defray the expenses of the meeting. The Associated Cable Companies have arranged to grant free cablegrams to all members of the Association who may at any time desire to communicate on strictly private matters with their friends in England. Each member will be allotted a number; this, and not his name, he will make use of in these cablegrams, which will be addressed in the first instance to the office of the Messrs. Cook, who have kindly undertaken to forward them to their destinations.

THE TELEGRAPH.

UNDERGROUND WIRE SUITS IN CHICAGO.—Five suits each against the Baltimore & Ohio and the Western Union telegraph companies, for violating a city ordinance in maintaining three wires above ground, were instituted by the city of Chicago this week The penalty in each of these suits is $1,000. It is understood that these are to be test cases.

THE COMMERCIAL CABLE COMPANY'S WIRES.—The Board of Aldermen of New York granted the petition of the Commercial Cable Company, on the 6th inst., to lay its wires and pneumatic tubes under ground. The conditions on which the petition was granted were unusually favorable to the city, since the company agrees not only to pay 1 cent a foot for the use of the streets for its buried cables, but to provide wires, wherever their subterranean system extends, for the police and fire alarm telegraphs.

OUR AMERICAN COUSIN.—Mr. Johnston, the Publisher and Editor of THE ELECTRICAL WORLD and *The Operator*, paid us his promised visit a few days ago, and we must confess that we spent a most enjoyable evening in that gentleman's company. THE ELECTRICAL WORLD, we are pleased to learn, has grown into an excellent property. A journal so admirably got up and so well edited, cannot fail to succeed in a go-ahead country like America. We asked Mr. Johnston if he would like to visit the Central Telegraph Office, and some of our great Electrical Works, but our American Cousin drily replied, "I have come over here for pleasure this time; and I do not intend visiting any place connected with business." We could not help agreeing with him, for we know he will have plenty of work when he gets back to the hurly-burly of New York. Mr. Johnston is at present enjoying the summer months with his family in a quiet corner of the "Emerald Isle." He returns to America in August.—*The Telegraphist.*

THE TELEGRAPH COMPANIES' FIGHT.—The New York, Ontario & Western Railway Company commenced an action in the Supreme Court on August 6 to restrain the Western Union Telegraph Company from interfering with the wires along the line of its road. An injunction was obtained from Judge Bartlett restraining the Western Union from any interference until further order of the court. In 1878 the Receivers of the Oswego Midland Railroad Company made an agreement with the Western Union, by which the wires along its lines were to be operated by the telegraph company. The number of wires then in possession of the Receivers and specified in the agreement was three. Subsequently the Ontario & Western Company purchased all the property of the Midland Company under foreclosure, the agreement with the Western Union being continued. This agreement terminated yesterday. About a week ago the Ontario & Western Company leased the wires in question to the Baltimore & Ohio Telegraph Company, to take effect upon the termination of the Western Union contract. After this contract was executed the Western Union Telegraph Company claimed to be the owner of one of the wires, and demanded that the railway company should either allow it the use of the wire or pay a large sum of money, and threatened if its terms were not conceded to tear down the wire at once. Its claim is based upon the fact that the wire in question was put up previous to 1878 by the Atlantic & Pacific Telegraph Company, and that notwithstanding subsequent proceedings it was still the property of the Atlantic & Pacific. As that company had been consolidated with the Western Union, the title of the wire, therefore, passed to the latter company. Judge Blatchford decided this point in favor of the railway company previous to 1878, deciding that the Atlantic & Pacific had no right, title or interest in the wire, The wires were turned over to the Baltimore & Ohio on the 6th, and a large amount of business has been transacted. The change cuts the Western Union off from connection with about 50 offices, many of them being quite important. The order to show cause why the injunctions should not be continued during the pendency of this suit is returnable before Judge Barnard, at Special Term, in Brooklyn, next Monday.

THE TELEPHONE.

ERIE MANAGEMENT.—The Boston *Herald* says: There is some opposition to the general manager, and talk of a change to the end that each officer shall spend his time where the plant is located. The incumbent of the office remains in the East most of the time, serving without pay and having trusted helpers in the West and Southwest.

TROPICAL TELEPHONE CO.—At the annual meeting, Col. Henry O. Russell, Charles Williams, Jr., Charles W. Jones, Nathan Appleton and James H. Howard were re-elected directors. Owing to the small attendance of shareholders, the financial report was not read, but was referred to the directors, who will receive the same at their next meeting, after which an abstract will be printed. The company's sales last year were about 3,000 sets of telephones. Since July 1, orders for over 400 sets have been received. The profits on sales last year (July 1, 1883, to July 1, 1884) were about $18,000.

EDISON'S MEGAPHONE.—The steamer Tallapoosa, which has taken Secretary Chandler and family to Newport, writes a Washington correspondent, has aboard it, for experimental purposes, one of Edison's most recent inventions, called the megaphone, which is nothing more nor less than a machine for magnifying sound, a sort of telescope for the ear. The effect and purpose of it are to enable a person to hear or carry on a conversation with people at a distance. The purpose of the invention is to aid mariners in listening for the sound of breakers, or carrying on conversation with people on shore or on other vessels at a distance.

A TELEPHONIC CAB SERVICE.—The New York Cab Company, limited, began on the 7th inst. a special service of their cheap cabs at the Grand Central Station. A stand has been erected at the southerly end of the station, inside of the gate, and an agent of the company will receive all passengers on the arrival of the trains. In addition, the Police Commissioners have detailed a special policeman to supervise this service outside of the station. Heretofore travellers have been unable to reach the cheap cabs, or in fact any other conveyances, except at great inconvenience, being forced to run the gauntlet of a small army of boisterous hackmen. Hereafter the cheap cabs may be ordered by telephone from the Forty-second street station. No extra charges are made by the company for their new accommodation to the public, although considerable expense has been incurred.

INDIANS AND THE TELEPHONE.—Not long ago, in St. Louis, some Apache chiefs were shown a telephone and permitted to hear through it a mysterious voice speaking from afar. They marveled exceedingly over it. They were the leaders of the most implacable of savage tribes. Their hands had often been wet with the blood of murdered men and women; war-whoops of their tribe were as familiar to their ears as the cry of the wild wolf; but that intangible small voice which came to their ears from the infinite, that was a new experience to them. One by one they listened to it; then, in silence, wrapping their blankets around them, went and sat down to think. After a while their tongues were loosened, and each gave his idea of what the voice in the telephone was. The final conclusion was that it was the white man's Great Spirit, as he talked in English, and their anxiety was to find the instrument through which the Indian's Great Spirit spoke to his children. They are now reported to be negotiating with some of the opposition companies for the said instrument.

THE ELECTRIC LIGHT.

RICHFIELD SPRINGS, N. Y., is now lighted by electricity, much to the satisfaction of the numerous summer visitors.

THE SAULT CANAL, CANADA.—This canal is now lighted by electricity. The power is generated by a turbine water wheel.

LIGHT, HEAT, ETC., IN BROOKLYN.—Articles of incorporation were filed in Brooklyn last week by the Municipal Electric Light Company. The capital stock is $250,000, and the purpose of the company is to supply Brooklyn with light, heat and motive power.

A HELP TO FRUIT GROWERS.—Once more the light has been found of use to farmers, fruit growers, and other cultivators. It is reported from California that at Los Angeles the fruit growers have been delighted to see the destruction of several bushels of moths and millers every night by the light, while at Sacramento the black beetle has been well nigh exterminated.

ACTION UPON COLORS.—MM. Depierre and Clouet have sent in a communication to the Chemical Section of the Industrial Society of Mulhouse on the action of the electric light and of solar light upon colors printed on cotton. They conclude that the electric light bleaches coloring matters; the colored rays of sunlight and of the electric light both being efficacious, though in different degrees. The action of light, solar or electric, is recognized, whether the colors are exposed to or protected from the air, and the activity of the rays increases in the following order: Yellow, blue, green, orange, violet, red.

THE THOMSON-HOUSTON IN CHICAGO.—The Chicago municipality has accepted the proposal of the Thomson-Houston Electric Company, of Boston, to furnish one six-light dynamo and six arc lights of the usual power to light the new Rush street bridge The dynamo and arc lights are to be free to the city in consideration of the privilege of an advertisement of the company's name and address being placed "in a reasonably conspicuous place" on the bridge. The city is to furnish wires, engines, and boilers, and bear all other expenses except as above stated.

THE PREECE EXPERIMENTS AT WIMBLEDON.—Mr. Preece has arrived at the following results in his tests at Wimbledon, near London: Taking ten candles as the average effective illumination given by five cubic feet of gas in a street lamp, the cost works out to ¼d. per lamp per hour for incandescent lighting.

The most efficient mode of distributing light in a street appears to be to hang a 50 candle-power lamp about 20 feet above the centre of the road at every 100 feet. For reflecting purposes, a polished nickel-plated iron surface of a slightly convex form and Trotter's dioptric system gave the best results.

HELL GATE.—It is expected that the electric light in the tower at Hallett's Point, Hell Gate, near New York, will be in operation before the close of the coming month. The skeleton iron frame-work for the light is completed, and is 250 feet in height. The boilers, two in number, are being made at the Delamater Iron Works, and it is not probable that they will be completed before September 15. These boilers and a Porter-Allen engine, which is not yet finished, are the only causes of delay. Nine Brush lamps, of 4,000 candle-power each, will be placed within five feet of the extreme height of the frame-work, and, in clear weather, will be seen at a distance of fifty miles.

LIGHTING UP "LIBERTY."—Mr. Cope Whitehouse, an Egyptologist, says: "Two years ago, while dining with Mr. J. W. Drexel, I made a suggestion with respect to the statue of Liberty. The torch should be a powerful ray of electric light, which would illuminate a cloud, and thus show the situation of New York to vessels far out at sea. The Navy Department very courteously requested Lieutenant McLean to make inquiries at Vienna and report. I saw this officer twice recently at Newport and I may say that he thinks that an optical apparatus could be placed in the flame of the torch from which an intense cylindrical beam of light could be projected. This beam of light striking the clouds would produce an illumination which could be seen at least 60 miles, and perhaps at a considerably greater distance. The apparatus would not be very expensive. It would consist of a Mangin aplanetic mirror of two feet in diameter and an automatic electric lamp supplied with an electric current of 60 ampères and 70 volts, costing perhaps $3,000."

MISCELLANEOUS NOTES.

THE LATEST YARN.—This is on the rounds: A German electrician has invented a battery which will do wonders if its plans could only be fully carried out. The electric battery is to be worked by sunlight mostly if not entirely, and the cost of the other elements is to be reduced to a minimum. If cheap and portable accumulators could be made for storing the electricity, the sunlight of a single summer could be made to store up force enough to drive all the mills and railroads for years.

NEW YORK'S ARTERIAL THOROUGHFARE.—On the 6th inst., the aldermen of this city voted a franchise to the Broadway Surface Railroad for nothing, although the value of the concession is generally estimated to be not less than $1,000,000. This action does not settle the matter. The intensely bitter opposition to any surface scheme is still felt by the public, and the commissioners appointed to determine the advisability of a surface road are still taking evidence on the subject. Property owners representing $50,000,000 are against any surface scheme.

THE ELECTRICAL COMMISSION.—The President has selected the following as members of the electrical commission to conduct experiments on the occasion of the exhibition at the Franklin Institute: Professor H. A. Rowland, Baltimore; Prof. John Trowbridge, Cambridge; Prof. G. F. Barker, Philadelphia; Prof. R. A. Fisk, San Francisco; Prof. M. B. Snyder, Philadelphia; Prof. J. Willard Gibbs, New Haven; Prof. Simon Newcomb, Washington; Prof. E. J. Houston, Philadelphia; Prof. C. A. Young, Princeton; Dr. W. H. Wahl, Philadelphia. Prof. Rowland is chairman, and the first meeting of the commission was fixed for the 7th inst., at Philadelphia.

ELECTRO-METALLURGY.—The Electro Metal Refining Company, of this city, says the Rome, N. Y., *Daily Sentinel*, started up on regular work last Saturday, refining lead by N. S. Keith's electrolytic process. The plant here is the first that has been erected to test the commercial practicability of refining base bullion by this method, and it is said that the apparatus employed accomplishes more work than expected. There are some details of apparatus to be arranged before the full capacity of the present plant is employed. About one-third of it is now in use. The purpose is to erect much larger works and to go into refining extensively on this plan, which secures better results at much less cost than the fire process.

SPEED INDICATORS.—A new speed indicator for marine engines has been invented by Mr. W. T. Goolden and Sir A. Campbell. A disc forming a sort of nut on a screw, driven by the engine shaft, turns in an opposite direction to the motion of the screw, and rolls on a cone kept turning at a uniform rate by means of clockwork. The position of the disc on the screw depends on the surface velocity of the cone. As it travels the disc makes a series of electric currents which indicate its position on a set of dials. Recording mechanism can also be attached. A somewhat similar apparatus has also been invented by Mr. W. Baily, having a circular plane or disc instead of the cone. The idea of using a screw for such a purpose is not new.

THE MISCELLANEOUS EXCHANGE.—A meeting of the New York Electric, Manufacturing, and Miscellaneous Stock Exchange was held on the 6th inst., and about twenty members engaged in an animated discussion of the report of a special committee appointed some time ago to investigate the management of the institution. Vice-President Benedict presided. The committee recommended that the Directors be required to report the facts concerning the purchase of a paper which is alleged to be printed in the interests of the Exchange. The paper was bought by the Directors, soon after the Exchange was started, for $6,500. An offer of $650 has recently been made for this paper. The discussion of the report brought out some pretty sharp criticism of the manager. The meeting voted to accept the report, and then laid it on the table.

TORPEDO GRADUATES.—The examination of the graduating army and navy class at the torpedo station, Newport, was held last week, Aug. 1. The examination included practical and theoretical electricity, the manufacture of fuses, the theory of torpedoes, embracing gunpowder and gun-cotton service torpedoes, description of the Lay-Haight torpedoes and defensive and offensive systems, and was illustrated with numerous practical experiments. The exercises proved that the members of the class have shown themselves remarkably efficient in connecting up batteries and handling the various electrical instruments, and especially so in the handling and explosion of torpedoes. On the 2d the class made some practical and very successful experiments with torpedoes and with incandescent light and the use of the arc light, in searching for objects in the water.

THE LIGHTNING CURE.—The following story comes from Port Jervis, this State: Abraham Cuddeback until a few weeks ago was a highly successful and much-respected merchant of Damascus, Penn. About three months ago, while attending church in his native place, he was stricken with paralysis, and had to be carried to his home. Ever since that time he has been helpless, and many physicians from New York and Philadelphia have been called in and have striven to give him aid, but all to no avail. About three weeks ago, utterly broken down in health and despondent, he was removed to Matamoras, Penn., directly opposite this village. A physician has been in constant attendance upon Mr. Cuddeback since his removal to Matamoras. During the prevalence of a heavy thunderstorm that visited this section of the country on the 5th, a huge ball of lightning struck a house very close to the residence of Mr. Cuddeback, and, entering the house through an open window, hurled Mr. Cuddeback to the floor from a chair on which he was sitting. He was alone at the time, and after lying on the floor unconscious for some time, his wife came in and helped him to a chair. Restoratives were applied and Mr. Cuddeback was soon himself again, and the happy discovery was made that he who a few minutes before was almost bereft of all feeling in his limbs, had entirely recovered the use of those members and was in apparent good health. Another peculiar phase of the case is that Mr. Cuddeback had no appetite a few weeks previous to this time, and after his strength and senses were restored he was taken suddenly hungry, and now has his accustomed appetite. The case is attracting considerable attention among the medical fraternity, and the many friends of the family in this vicinity are showering their congratulations on the happy pair for the recovery of Mr. Cuddeback's faculties and strength. The case is to be fully investigated by the physicians who have had charge of this most remarkable case.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations are as follows on the New York Stock Exchange, the Boston Exchange and elsewhere:

TELEGRAPH.—Am. Cable, b 55, a 55¼; Western Union, b 64½, a 64⅝.

At higher quotations Western Union has been steady during the week. Mr. Gould now predicts 75 for it in the near future.

The earnings at the test offices of the Western Union Telegraph for the week ended Aug. 2 were $168,742, a gain over last year of $20,860. It is to be remembered, however, that the great strike was in progress last year.

TELEPHONE.—American Bell, a 161; Erie, b 19; Mexican, a 2 1/16; New England, a 25; Tropical, a 1½.

The Boston *Herald* of Aug. 7 says: New England telephone shares further reacted to 25 to-day, Bell, Erie and Mexican remaining practically steady.

The Boston *Transcript* remarks: Some people are shrewd enough to see that dividends weaken a company as much as any other unremunerative payments. The New England Telephone Company is promptly meeting all the construction demands made upon it, and working in so thickly settled and well developed a territory, will be in a position in 1885 to maintain its constructions from earnings and pay something to its stockholders. The Erie Telephone Company, which operates from Lake Superior and Lake Erie to the Gulf of Mexico, has been pursuing the policy of deferring construction as much as possible in order that dividends may be maintained. This has restricted the telephone output by the American Bell Telephone Company. But the Erie Telephone has probably paid its last dividend for some time, and if it enters 1885 as a non-dividend company, it will gain in prosperity and in the market price of its stock.

ELECTRIC LIGHT.—American, b 9; Edison, b 75, a 100; Edison Isolated, a 70

Kohlsaat & Co., No. 30 Pine street, furnish the following quotations for miscellaneous securities:

	About.		About.
American Bell	161	People's Tel	17
Mexican Telephone	20	New Eng. Tel	25
N. Y. & N. J. Tel.	54	Globe Tel	15
Hudson River Tel	80		

BUSINESS NOTICES.

THE MCFALL MAGNETO BELL.—The Standard Electrical Works, Cincinnati, O., are calling the special attention of telephone men to their McFall combination magneto bell, of which they have the exclusive manufacture and sale throughout the country. Its various merits are enumerated in the announcement of the works in our advertising columns. We shall soon describe the bell.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED JULY 22, 1884.

Dynamo-Electric Machine; R. H. Mather, of Windsor, Ct. 302,418
The widening is performed by using a cable consisting of a number of insulated wires, and when wound the several wires are connected at their ends so that they are put in electrical series.

Dynamo-Electric Machine; J. J. Wood, of Brooklyn, N. Y., Assignor to the Fuller Electrical Co., of New York. 302,460
A hand-wheel is placed conveniently on a dynamo and is connected by cogs with the yoke carrying the brushes. By rotating the wheel the brushes are moved to-and-fro on the commutator to regulate the current. A stop and index are provided so that the wheel may be locked at any desired point and the number of lamps which the current produced at that point will support is indicated by the pointer.

Electric Cable; Edward M. Bentley, Brooklyn, N. Y. 302,377
The combination of a number of direct conductors and a common return conductor therefor, each direct, and the common return being equally distant from any wire external to the system.

Electrical Safety Appliance; K. W. Hedges, of Westminster, England. 302,485
Whenever the current in an electric circuit rises to endanger the safety plug, a bell is automatically rung to notify the attendant.

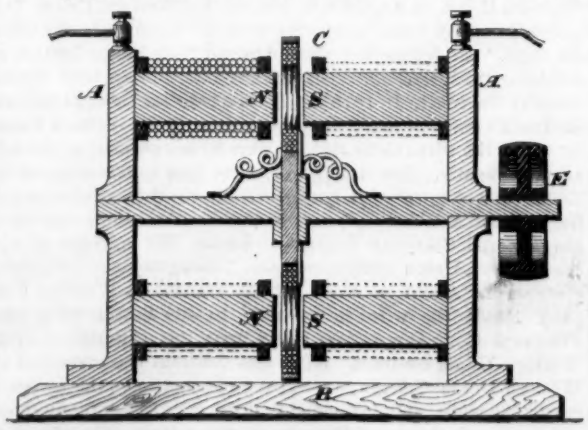
Electric Train Signal; L. W. Lindley, of Danville, Ky. 302,505
Devices adapted for application to moving trains, with the object of providing means of communication between moving trains on the same track.

Feed Water Alarm; G. W. Getchell, of Brewer, Me. 302,245
A float rises and falls with the surface of the water in a steam boiler, and makes an electric bell-alarm circuit at the extremes.

Mode of Winding Field-Magnets of Dynamo-Electric Machines; R. H. Mather, of Windsor, Ct. 302,417
This refers to the field magnets of the Mather dynamos. These magnets are nearly a complete ring. Each is suspended by a cord, and as the widening progresses with each convolution of the wire, it is passed through between the poles and the magnet is turned once on the horizontal plane.

Quadruplex Telegraph; F. W. Jones, of New York City. 302,410
Consists in details of construction and combinations of relays and sounders, for transmitting four messages, two each way, over the same circuit without confusion, and with economy in battery-power.

Dynamo-Electric Machine; Charles F. Brush, of Cleveland, O. 302,319
This patent results from the division of a specification filed



Jan., 1879. The machine belongs to the class for producing alternating currents, such as is known as the Ferranti or disc machine. *C* are the bobbins wound without iron cores, *N S* are the respective poles of two opposed series of electro field-magnets.

System of Communication with Moving Trains; G. E. Fullerton, of Paris, Iowa. 302,475
Consists in the application of electric lights for the purpose of warning trains of danger, and in a suitable arrangement of apparatus therefor.

Synchronous Telegraphy; Poul La Cour, of Copenhagen, Denmark, Assignor to Fred. P. Jones, of Portsmouth, N. H. 302,502
Improvement on his means patented May 7th, 1878, and consists in the arrangement and grouping of a series of independent contacts into different circuits for multiplex transmission.

Telephone Exchange System; W. H. Knight, of New York City. 302,344
Relates to switchboards for double lines.

Telephone Switch; H. K. Goodwin, of Lawrence, Mass., Assignor of one-half to A. D. Swan, of same place. 302,330
Consists in a compound hand switch included in the flexible cord conductor usually employed, and provided with various connections whereby any subscriber may be connected with another or to ground, and when so connected can be easily signaled or put in telephonic communication with the central office operator.

Telegraphic Transmitter; C. G. Spengler, of Hoboken, N. J., Assignor to Wm. A. Leggo, of Montreal, Can. 302,360
Consists in the combination in a telegraphic transmitter of a sliding contact-piece, and another contact-piece operating in conjunction therewith and movable toward and from the sliding contact-piece in a direction transverse to the line of movement of the sliding contact-piece, and means for imparting motion to the contact pieces for the purpose of transmitting the telegraphic signals.

Telephone Exchange System; H. E. Waite and S. H. Bartlett, of New York City, Assignors to Chas. F. Livermore, Trustee, of same place. 302,364
Employs in a listening telephone system an annunciator-drop, which by its action breaks the normal circuit of the subscriber's line, and automatically connects him with a telephone strapped to the ear of the listener at the central office, enabling the subscriber at once, without waiting for an answering signal, to communicate with the central office, and to name the subscriber with whom he desires to be put in communication.

Underground Electric Way; E. M. Bentley, of Brooklyn, N. Y. 302,378
Consists in improvements upon the means patented by W. H. Knight and himself on May 1, 1883. The wires are laid within the conduit so as to preserve equal and opposite inductive effects each upon the others. This is mainly accomplished by twisting, or crossing the wires from side to side, or both.